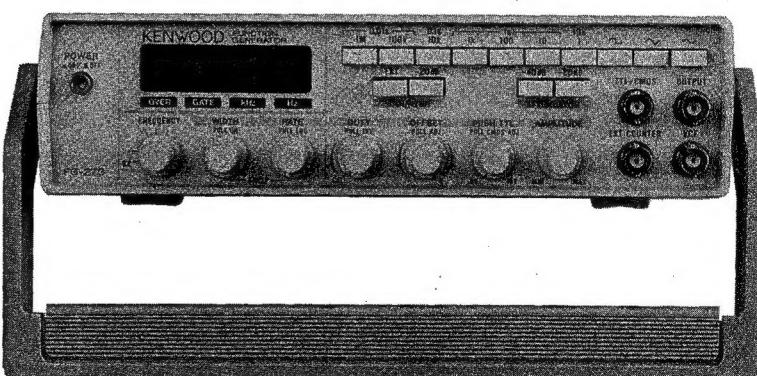


FUNCTION GENERATOR
FG-273

SERVICE MANUAL

KENWOOD CORPORATION



WARNING

The following instructions are for use by qualified personnel only. To avoid electric shock, do not perform any servicing other than contained in the operating instructions unless you are qualified to do so.

CONTENTS

SPECIFICATIONS	3
SAFETY	5
ADJUSTMENT	6
PARTS LIST.....	8
SCHEMATIC DIAGRAM.....	11
P.C. BOARD	14

SPECIFICATIONS

Frequency Characteristics	
Outputs	Sine, square, triangle, pulse, ramp, TTL/CMOS square wave
Frequency range	0.02 Hz to 2 MHz in 7 frequency ranges (1/10/100/1k/10k/100k/1M)
Accuracy (1)	± 1 digit, 4-digit max. (digital readout to output frequency)
Accuracy (2)	$\pm 5\%$ of full scale (0.2 Hz to 2 MHz) (frequency dial to output frequency)
External frequency control (VCF)	
Input voltage	0 to +10 V DC. Frequency decreases with positive voltage
Variable frequency range	Greater than 1000:1
Variable symmetry	Variable over 1:1 to 40:1 range
DC offset	Continuously variable, maximum of ± 10 V open circuit, ± 5 V into 50 ohms.
Polarity	Inverted or non-inverted
Sine Wave	
Distortion	Less than 1%, 10 Hz to 100 kHz
Amplitude flatness	Within ± 1.0 dB to 100 kHz at maximum output amplitude
Output	Variable amplitude
Square Wave	
Symmetry	Less than $\pm 3\%$ at 100 Hz
Rise and fall time	Less than 100 ns at maximum output
Output	Variable amplitude
Triangle Wave	
Linearity	Less than 1% at 100 Hz
Output	Variable amplitude
TTL Output	
Rise and fall time	Less than 25 ns
Output	TTL level
CMOS Output	
Rise and fall time	Less than 60 ns
Output	+5 to +15 V, continuously variable
Sweep Characteristics	
Internal	Linear or logarithm
Sweep rate	0.5 Hz (2 s) to 50 Hz (20 ms), continuously variable
Sweep width	Variable from 10:1 to 1000:1
External sweep	Front panel VCF jack, Input impedance is 11.5 k Ω .

SPECIFICATIONS

Frequency Counter Characteristics	
Frequency range	5 Hz to 10 MHz (10 s, 1 s, 0.1 s, 0.01 s)
Accuracy	±1 count time base accuracy
Stability	Less than ±20 ppm, 0°C to 40° C
Input sensitivity	30 mV rms, 5 Hz to 10 MHz
Maximum input voltage	150 V rms at 1 kHz
Input impedance	Approx. 500 kΩ [0 dB], Approx. 1 MΩ [20 dB]
Output	
Amplitude	20 Vp-p Open circuit, 10 Vp-p into 50 ohms.
Attenuator	Steps of -20 dB, -20 dB and -40 dB. Continuously variable
Impedance	50 ohms, ±10%
Power Requirements	
Input voltage	AC 100 V/120 V/220 V/240 V ±10%
Frequency	50 Hz/60 Hz
Power consumption	Approx. 20 VA
Environmental Conditions	
Storage	-20°C to 60°C, Less than 70% humidity
Operating	0°C to 40°C, Less than 80% humidity
Specification	23°C ± 5°C, Less than 70% humidity
Dimensions and Weight	
Dimensions	240 (W) × 64 (H) × 190 (D) mm
Weight	1.8 kg
Accessories	
Instruction manual	× 1
AC cord	× 1
Fuse	0.3 A (slow-blow type) × 1 0.2 A (fast-blow type) × 1

* Circuit and rating are subject to change without notice due to developments in technology.

SAFETY

SAFETY

Before connecting the instrument to a power source, carefully read the following information, then verify that the proper power cord is used and the proper line fuse is installed for power source. The specified voltage is shown near of the AC inlet. If the power cord is not applied for specified voltage, there is always a certain amount of danger from electric shock.

Line voltage

This instrument operates using ac-power input voltages that 100/120/220/240 V at frequencies from 50 Hz to 60 Hz.

Power cord

The ground wire of the 3-wire ac power plug places the chassis and housing of the instrument at earth ground. Do not attempt to defeat the ground wire connection or float the instrument; to do so may pose a great safety hazard. The appropriate power cord is supplied by an option that is specified when the instrument is ordered.

The optional power cords are shown as follows in Fig. 1.

Line fuse

The fuse holder is located on the rear panel and contains the line fuse. Verify that the proper fuse is installed by replacing the line fuse.

Voltage conversion

This instrument may be operated from either a 100 V to 240 V, 50/60 Hz power source. Use the following procedure to change from 100 to 240 volt operation or vice versa.

1. Replace fuse FS1 with a fuse of appropriate value, 0.3 A slow-blow type for 100 VAC to 120 VAC operation, 0.2 A fast-blow for 220 VAC to 240 VAC operation.
2. Reinsert it for appropriate voltage range.
3. When performing the reinsertion of fuse holder for the voltage conversion, the appropriate power cord should be used. (See Fig. 1.)

Plug configuration	Power cord and plug type	Factory installed instrument fuse	Line cord plug fuse	Parts No. for power cord and plate
	North American 120 volt/60 Hz Rated 15 amp (12 amp max; NEC)	0.3 A, 250 V Slow blow 6 x 30 mm	None	Cord: E30-1820-05
	Universal Europe 220 volt/50 Hz Rated 16 amp	0.2 A, 250 V Fast blow 6 x 30 mm	None	Cord: E30-1819-05
	U.K. 240 volt/50 Hz Rated 13 amp	0.2 A, 250 V Fast blow 6 x 30 mm	0.8 A Type C	—
	Australian 240 volt/50 Hz Rated 10 amp	0.2 A, 250 V Fast blow 6 x 30 mm	None	Cord: E30-1821-05
	North American 240 volt/60 Hz Rated 15 amp (12 amp max; NEC)	0.2 A, 250 V Fast blow 6 x 30 mm	None	—
	Switzerland 240 volt/50 Hz Rated 10 amp	0.2 A, 250 V Fast blow 6 x 30 mm	None	—

Fig. 1 Power Input Voltage Configuration

ADJUSTMENT

CASE DISASSEMBLY AND ASSEMBLY

1. To open the case, turn the unit upside down with the rubber feet facing up. (See Fig. 2)
2. Remove the four screws from the bottom case.
3. Carefully separate the two halves of the case and recalibrate the unit following the prescribed procedure.

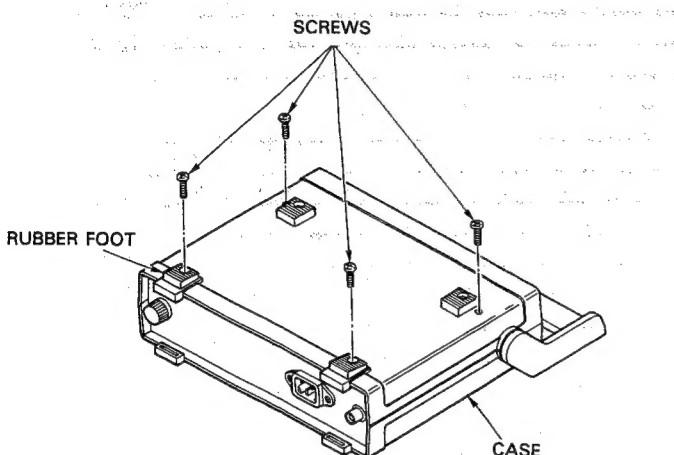


Fig. 2

4. To close the case, lower the bottom case and guide the front and rear panels into their slots. Position the rubber feet as illustrated and screw the two halves of the case together.

Do not overtighten screws.

100/120/220/240 VOLT CONVERSION

This instrument operates from a 100 V, 120 V, 220 V or 240 V AC, 50 to 60 Hz line-voltage source. The applied voltage is indicated on the rear panel. To convert from the specified voltage to other line voltages, replace the voltage plug position on PC Board, referring to the figure below and change the rear panel applied voltage indication. Also, be sure to replace the fuse to correspond to the line voltage 0.3 A slow-blow fuse for 100 V to 120 V operation and 0.2 A fast-blow fuse for 220 V to 240 V operation. If it is not wired to your local line voltage, set the power transformer wiring as shown below. (See Fig. 3.)

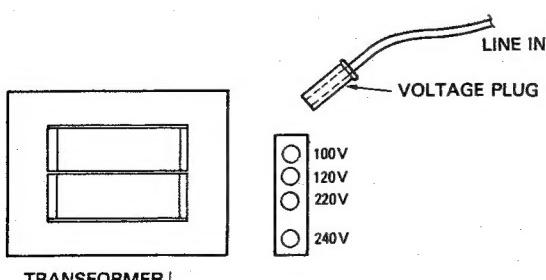


Fig. 3

TEST EQUIPMENT REQUIRED

- Digital Multimeter: KENWOOD DL-707 or equivalent
- Oscilloscope: KENWOOD CS-1022 or equivalent
- Frequency Counter: KENWOOD FC-756 or equivalent
- Distortion Analyzer: Y.H.P 334A or equivalent
- DC Power Supply: KENWOOD PD18-10 or equivalent

AMPLIFIER INTERNAL DC OFFSET AND TRIANGLE WAVE AMPLITUDE ADJUSTMENT

1. Push function switch to OFF position, load 50 ohms.
2. Push range switch to OFF position, ATT switch OFF.
3. Amplitude to minimum.
4. Adjust R88 to get -5 mV at the main out BNC jack.
5. Push function switch to "TRIANGLE WAVE", setting amplitude VR at maximum.
6. Push range switch to 100 kHz.
7. Tuning the frequency dial to 1.0 position approximately.
8. Adjust the resistor R91 to get 10.4 ± 0.1 Vp-p main output level and make sure the wave form are not clipping.
9. Check all range except MHz that triangle wave output amplitude more than 10.25 Vp-p.
10. Re-adjust resistor R91 to obtain 10.25 Vp-p output at any critical frequency point.
11. Repeat step 1 to 4 to maintain -5 mV DC voltage at main output BNC.

TRIANGLE WAVE FREQUENCY RESPONSE ADJUSTMENT

1. Push function switch to "TRIANGLE WAVE".
2. Push range switch to 1 MHz, amplitude VR MAX.
3. Tuning the frequency dial to 2.0 position approximately.
4. Load 50 ohms and ATT switch OFF.
5. Adjust the C13 to get 10.4 ± 0.1 V main output level and make sure the wave form are not clipping.

SQUARE WAVE RISE & FALL TIME ADJUSTMENT

1. Push function switch to "SQUARE WAVE", amplitude VR MAX.
2. Push range switch to 100 kHz.
3. Tuning frequency dial to 2.0 position.
4. Load 50 ohms, ATT switch OFF.
5. In maximum output amplitude condition, adjust C25 to reduce over shoot phenomenon.
6. Push range switch to 1 MHz, check rise/fall time for less than 100 ns.
7. Repeat step 5, 6 to minimize over shoot and maintain rise/fall time.

SQUARE WAVE AMPLITUDE ADJUSTMENT

1. Push function switch to "SQUARE WAVE".
2. Push range switch to 1 MHz, amplitude VR MAX.
3. Tuning frequency dial to 2.0 position.
4. Load 50 ohms, ATT switch OFF.
5. Adjust R79 (square wave output amplitude) to get 10.4 ± 0.1 Vp-p main output level.

ADJUSTMENT

SINE WAVE AMPLITUDE ADJUSTMENT

- Push function switch to "SINE WAVE".
- Push range switch to 100 kHz, dial scale setting at 1.0 position.
- Load 50 ohms, ATT switch OFF, amplitude VR MAX.
- Adjust R75 (sine wave output amplitude) to get 10.4 ± 0.1 Vp-p level from main output and make sure the waveform do not clip on the top and bottom.

SINE WAVE, FREQUENCY RESPONSE ADJUSTMENT

- Push function switch to "SINE WAVE".
- Push range switch to 1 M, amplitude VR MAX.
- Turn the frequency dial to 2.0 position approximately.
- Load 50 ohms, ATT switch OFF.
- Adjust C23 (sine wave response) to get 10.4 ± 0.1 Vp-p level from main output and make sure the signal are not clipping.

SINE WAVE DISTORTION ADJUSTMENT

- Set sweep width VR, rate VR, duty VR, offset VR to minimum situation. Offset VR press in to internal offset position.
- Push function switch to "SINE WAVE".
 - Push range switch to 100 kHz.
 - Tuning frequency dial to 0.2 position.
 - Adjust R35 make potential equal (within ± 10 mV) between Q5 gate and pin 10 of U5.
 - Adjust R11, R19 make DC voltage equal between pin 2 and pin 3 of both U1 and U2.
 - Push range switch to 100 Hz, adjust R45 CW to MAX.
 - Adjust R48 to reduce 20 Hz distortion.
 - Readjust R45 to reduce 20 Hz distortion.
 - Repeat step 7 and 8 to minimize 20 Hz distortion for less than 0.8%.
 - Push range switch to 100 kHz, setting frequency dial to 1.0 position.
 - Check distortion of 100 kHz for less than 0.8%.
 - Repeat step 7 to 8 for maintain distortion less than 0.8%.

FREQUENCY ACCURACY ADJUSTMENT

- Push function switch to triangle wave.
- Push range switch to 100 kHz, amplitude VR MAX.
- Tuning frequency VR to 2.0 position.
- Adjust R7 for a counter display reading 200 kHz.
- Check all ranges accuracy and function are in full scale $\pm 4.5\%$.
- Repeat steps 4 and 5.
- Tuning frequency VR to 0.2 position.
- Check all function and frequency except MHz range frequency accuracy are in full scale $\pm 4.5\%$.
- Repeat steps 3 to 7 to complete step 8.

1 M RANGE FREQUENCY ADJUSTMENT

- Push function switch to triangle wave.
- Push range switch to 1 MHz, amplitude VR MAX.
- Tuning frequency VR to 2.0 position.
- Adjust C8 for a counter display reading 2 MHz.
- Tuning frequency VR to 0.2 position.
- Check all function frequency accuracy is in full scale $\pm 4.5\%$.
- Repeat steps 3 to 5 to complete step 6.

COUNTER SENSITIVITY ADJUSTMENT

- Push the counter INT/EXT switch to EXT mode, dial scale setting at cw max.
- Set range switch at 1 M range, amplitude VR max, function switch setting at triangle.
- Adjust R159 to make reading ".0" with no signal input to EXT counter input BNC jack.
- Check counter sensitivity by 10 MHz 30 mV RMS.
- Repeat step 3 and 4 to maintain both sensitivity spec and repress interfere of signal generator circuit.

COUNTER ACCURACY ADJUSTMENT

- Warm-up the instrument at least thirty minutes.
- Input 10 MHz 30 mVrms sine wave to EXT counter BNC connector.
- Push the range mode switch to 1 k range (gate time 1 s) adjust C43 SVC to 000.000 kHz (OVER LED lights on simultaneously).

LOG SWEEP WIDTH ADJUSTMENT

- Pull rate control VR and turn C.W.
- Connect oscilloscope input to TP1.
- Adjust R176 (470 ohm) to get +13.5/-0.5 V log wave form.

PARTS LIST

REF. NO	PARTS NO	NAME & DESCRIPTION	NAME & DESCRIPTION
D061	IN4148	DIODE	DIODE
D062	IN4148	DIODE	DIODE
D063	IN4148	DIODE	DIODE
D064	IN4148	DIODE	DIODE
D065	IN4148	DIODE	LED, RED
D066	B30-0959-08	LED, RED	DIODE
D067	IN4148	DIODE	DIODE
D068	IN4148	DIODE	DIODE
D069	B30-0959-08	LED, RED	DIODE
D070	IN4148	DIODE	DIODE
D071	IN4148	DIODE	DIODE
D072	IN4148	DIODE	DIODE
D073	IN4148	DIODE	DIODE
D074	IN4001	DIODE	DIODE
D075	IN4001	DIODE	DIODE
D076	IN4001	DIODE	DIODE
D077	IN4001	DIODE	DIODE
D080	IN4001	DIODE	DIODE
D081	IN4001	DIODE	DIODE, ZENER 8.2V
D082	R08.2E(B2)	DIODE	DIODE
D083	IN4001	DIODE	DIODE
Q001	ZSC1815(GR)	TR. SI. NPN	TR. SI. NPN
Q002	ZSA1015(GR)	TR. SI. PNP	TR. SI. PNP
Q003	ZSA1015(GR)	TR. SI. PNP	TR. SI. PNP
Q004	ZSC1815(GR)	TR. SI. NPN	FET, N-CHANNEL
Q005	2N5485	TR. SI. PNP	TR. SI. PNP
Q006	ZSA1015(GR)	TR. SI. PNP	TR. SI. PNP
Q007	ZSA1015(GR)	TR. SI. PNP	TR. SI. PNP
Q008	ZSC1674(K)	TR. SI. NPN	TR. SI. NPN
Q009	ZSC1674(K)	TR. SI. NPN	TR. SI. NPN
Q010	ZN3906	TR. SI. NPN	TR. SI. NPN
Q011	ZSC1674(K)	TR. SI. NPN	TR. SI. NPN
Q012	ZN2219A	TR. SI. NPN	TR. SI. NPN
Q013	ZN2905A	TR. SI. NPN	TR. SI. NPN
Q016	LM7815	IC, 3-TERMINAL POSI. REGULATOR	IC, 3-TERMINAL POSI. REGULATOR
Q017	TIP32B	TR. SI. PNP	TR. SI. PNP
Q018	8050C	TR.	TR.
Q019	ZN3906	TR. SI. PNP	TR. SI. PNP
Q020	ZSC1815(GR)	TR. SI. NPN	TR. SI. NPN
Q021	ZSC1815(GR)	TR. SI. PNP	TR. SI. PNP
Q022	ZSA1015(GR)	TR. SI. PNP	TR. SI. PNP
Q023	ZSC1815(GR)	TR. SI. NPN	TR. SI. NPN
Q024	LM7805	IC, 3-TERMINAL POSI. REGULATOR	IC, 3-TERMINAL POSI. REGULATOR
Q025	ZSA1015(GR)	TR. SI. PNP	TR. SI. PNP
Q026	ZSA1015(GR)	TR. SI. PNP	TR. SI. PNP
Q027	ZSA1015(GR)	TR. SI. PNP	FET, N-CHANNEL
Q028	2N5485	TR. SI. NPN	TR. SI. NPN
Q029	ZSC1815(GR)	DISPLAY(ORANGE)	DISPLAY(ORANGE)
Q055	B30-0960-08	DISPLAY(ORANGE)	DISPLAY(ORANGE)
Q056	B30-0960-08	DISPLAY(ORANGE)	DISPLAY(ORANGE)
Q057	B30-0960-08	DISPLAY(ORANGE)	DISPLAY(ORANGE)
Q058	B30-0960-08	DISPLAY(ORANGE)	DISPLAY(ORANGE)
Q059	B30-0960-08	DISPLAY(ORANGE)	DISPLAY(ORANGE)
Q060	B30-0960-08	DISPLAY(ORANGE)	DISPLAY(ORANGE)
U001	UA741	IC, OP AMP.	IC, OP AMP.
U002	UA741	IC, OP AMP.	IC, OP AMP.
U003	UA308	IC, OP AMP.	IC, OP AMP.
U004	UA308	IC, OP AMP.	IC, OP AMP.
U005	CA3086	IC, NPN TRANSISTOR ARRAY	IC, DUAL 4-INPUT NAND GATE
U006	SN7420N	IC, QUAD. 2-INPUT NAND GATE	IC, QUAD. 2-INPUT NAND GATE
U007	SN7426N	IC, OP AMP.	IC, OP AMP.
U008	CA3030	IC, DUAL OP AMP.	IC, DUAL OP AMP.
U009	UA741	IC, DUAL OP AMP.	IC, DUAL OP AMP.
U010	LM358	IC, DUAL OP AMP.	IC, DUAL OP AMP.
U011	LM358	IC, OP AMP.	IC, OP AMP.
U012	UA741	IC, OP AMP.	IC, B-DIGIT FREQ. COUNTER/TIMER
U013	ICM7216D	IC, QUAD. ANALOG SW/QUAD. MPX	IC, QUAD. ANALOG SW/QUAD. MPX
U014	MC14066	IC, TRIPLE LINE RECEIVER	IC, TRIPLE LINE RECEIVER
U015	MC10116P	IC, OP AMP.	IC, OP AMP.
U016	UA741	IC, OP AMP.	IC, OP AMP.

SEMICONDUCTOR

REF. NO	PARTS NO	NAME & DESCRIPTION
D001	IN4148	DIODE
D048	IN4148	DIODE
D049	IN4747A	DIODE, ZENER 20V
D050	IN4148	DIODE
D051	B30-0959-08	LED, RED
D052	IN4148	DIODE
D053	IN4148	DIODE
D054	B30-0959-08	LED, RED

PARTS LIST

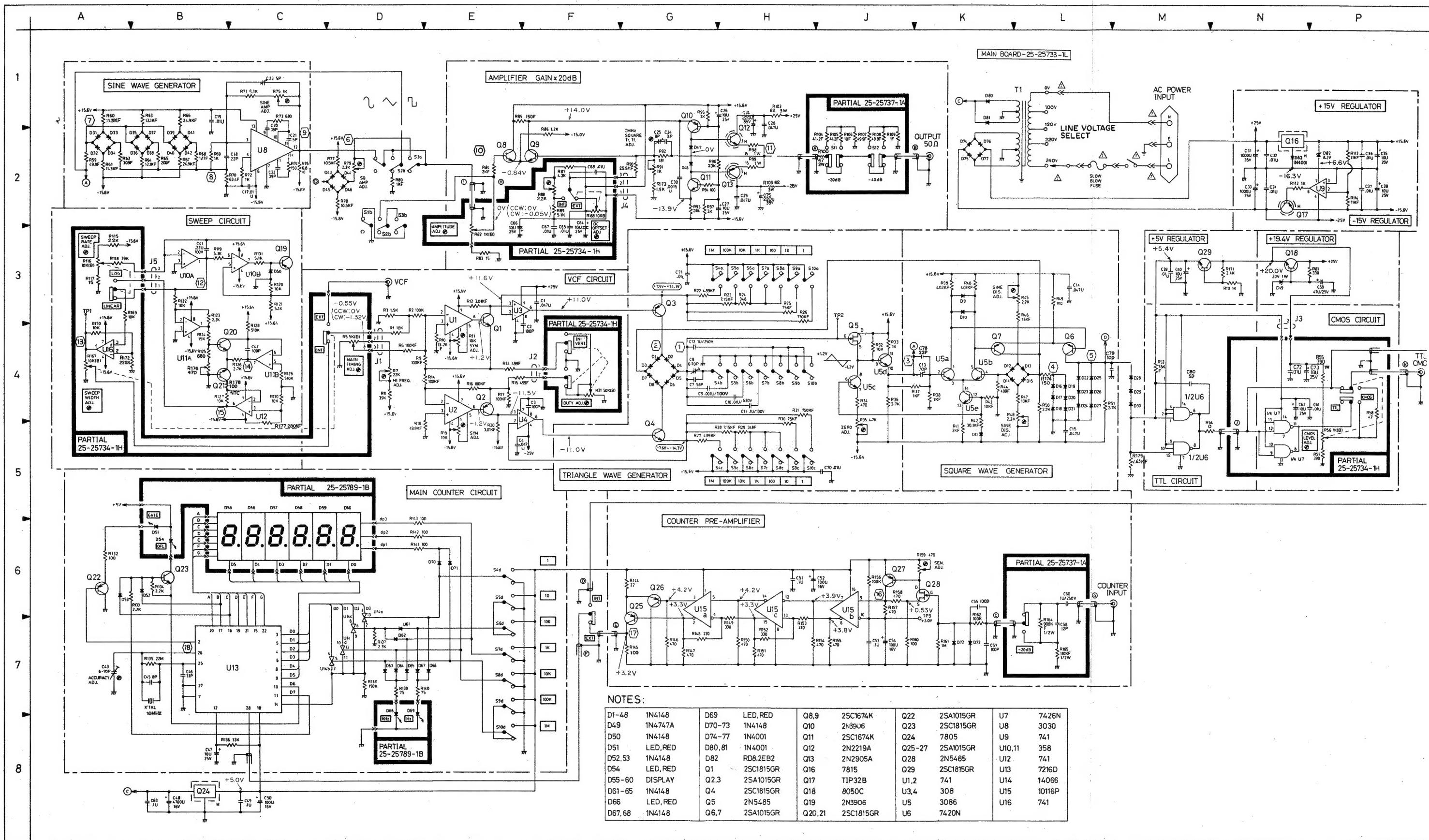
RESISTOR

REF. NO	PARTS NO	NAME & DESCRIPTION
R001	RD14BK2C103J	RES. CARBON 10K 5% 1/6W
R002	RN14BK2C1003F	RES. METAL FILM 100K 1% 1/6W
R003	RD14BB2C152J	RES. CARBON 1.5K 5% 1/6W
R004	NO USE	
R005	R01-2522-08	V.R. SKB
R006	RN14BK2C1003F	RES. METAL FILM 100K 1% 1/6W
R007	R12-3040-05	RES. SEMI FIXED 22K B
R008	RD14BB2C393J	RES. CARBON 39K 5% 1/6W
R009	RN14BK2C1003F	RES. METAL FILM 100K 1% 1/6W
R010	RN14BK2C3322F	RES. METAL FILM 33.2K 1% 1/6W
R011	R12-3041-05	RES. SEMI FIXED 10KB
R012	RN14BK2C3011F	RES. METAL FILM 3.01K 1% 1/6W
R013	RN14BK2C4990F	RES. METAL FILM 499 1% 1/6W
R014	RN14BK2C1003F	RES. METAL FILM 100K 1% 1/6W
R015	RN14BK2C4990F	RES. METAL FILM 499 1% 1/6W
R016	RN14BK2C1003F	RES. METAL FILM 100K 1% 1/6W
R017	RN14BK2C1003F	RES. METAL FILM 100K 1% 1/6W
R018	RN14BK2C4992F	RES. METAL FILM 49.9K 1% 1/6W
R019	R12-3041-05	RES. SEMI FIXED 10KB
R020	RN14BK2C3011F	RES. METAL FILM 3.01K 1% 1/6W
R021	R01-4508-08	V.R. WITH SW 50KB
R022	RN14BK2C4991F	RES. METAL FILM 4.99K 1% 1/6W
R023	RN14BK2C7151F	RES. METAL FILM 7.15K 1% 1/6W
R024	RN14BK2C3480F	RES. METAL FILM 348 1% 1/6W
R025	RN14BK2C7502F	RES. METAL FILM 75K 1% 1/6W
R026	RN14BK2C7503F	RES. METAL FILM 750K 1% 1/6W
R027	RN14BK2C4991F	RES. METAL FILM 4.99K 1% 1/6W
R028	RN14BK2C7151F	RES. METAL FILM 7.15K 1% 1/6W
R029	RN14BK2C3480F	RES. METAL FILM 348 1% 1/6W
R030	RN14BK2C7502F	RES. METAL FILM 75K 1% 1/6W
R031	RN14BK2C7503F	RES. METAL FILM 750K 1% 1/6W
R032	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R033	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R034	RD14BB2C471J	RES. CARBON 470 5% 1/6W
R035	R12-1028-05	RES. SEMI FIXED 4.7KB
R036	RD14BB2C272J	RES. CARBON 2.7K 5% 1/6W
R037	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W
R038	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W
R039	RN14BK2C4021F	RES. METAL FILM 4.02K 1% 1/6W
R040	RN14BK2C4021F	RES. METAL FILM 4.02K 1% 1/6W
R041	RN14BK2C2001F	RES. METAL FILM 2K 1% 1/6W
R042	RN14BK2C3012F	RES. METAL FILM 30.1K 1% 1/6W
R043	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W
R044	RN14BK2C4990F	RES. METAL FILM 499 1% 1/6W
R045	R12-1033-05	RES. SEMI FIXED 2.2K B
R046	RN14BK2C1302F	RES. METAL FILM 13K 1% 1/6W
R047	RN14BK2C1302F	RES. METAL FILM 13K 1% 1/6W
R048	R12-1033-05	RES. SEMI FIXED 2.2K B
R049	RD14BB2C910J	RES. CARBON 91 5% 1/6W
R050	RD14BB2C272J	RES. CARBON 2.7K 5% 1/6W
R051	RD14BB2C272J	RES. CARBON 2.7K 5% 1/6W
R052	NO USE	
R053	RN14BK2C7501F	RES. METAL FILM 7.5K 1% 1/6W
R054	R92-1061-05	JUMPING RES. ZERO OHM
R055	RS14AB3A391J	RES. METAL FILM 390 5% 1W
R056	R01-1518-08	V.R. WITH SW 1KB
R057	RD14BB2C391J	RES. CARBON 390 5% 1/6W
R058	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R059	RN14BK2C499RF	RES. METAL FILM 49.9 1% 1/6W
R060	RN14BK2C1132F	RES. METAL FILM 11.3K 1% 1/6W
R061	RN14BK2C1132F	RES. METAL FILM 11.3K 1% 1/6W
R062	RN14BK2C3090F	RES. METAL FILM 309 1% 1/6W
R063	RN14BK2C1212F	RES. METAL FILM 12.1K 1% 1/6W
R064	RN14BK2C1212F	RES. METAL FILM 12.1K 1% 1/6W
R065	RN14BK2C2000F	RES. METAL FILM 200 1% 1/6W
R066	RN14BK2C492F	RES. METAL FILM 24.9K 1% 1/6W
R067	RN14BK2C247F	RES. METAL FILM 24.9K 1% 1/6W
R068	RN14BK2C1270F	RES. METAL FILM 127 1% 1/6W
R069	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R070	RN14BK2C63R4F	RES. METAL FILM 63.4 1% 1/6W
R071	RD14BB2C512J	RES. CARBON 5.1K 5% 1/6W
R072	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R073	RD14BB2C681J	RES. CARBON 680 5% 1/6W
R074	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R075	R12-1029-05	RES. SEMI FIXED 1K B
R076	RD14BB2C682J	RES. CARBON 6.8K 5% 1/6W
R077	RN14BK2C1052F	RES. METAL FILM 10.5K 1% 1/6W
R078	RN14BK2C1052F	RES. METAL FILM 10.5K 1% 1/6W
R079	R12-1033-05	RES. SEMI FIXED 2.2K B
R080	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W

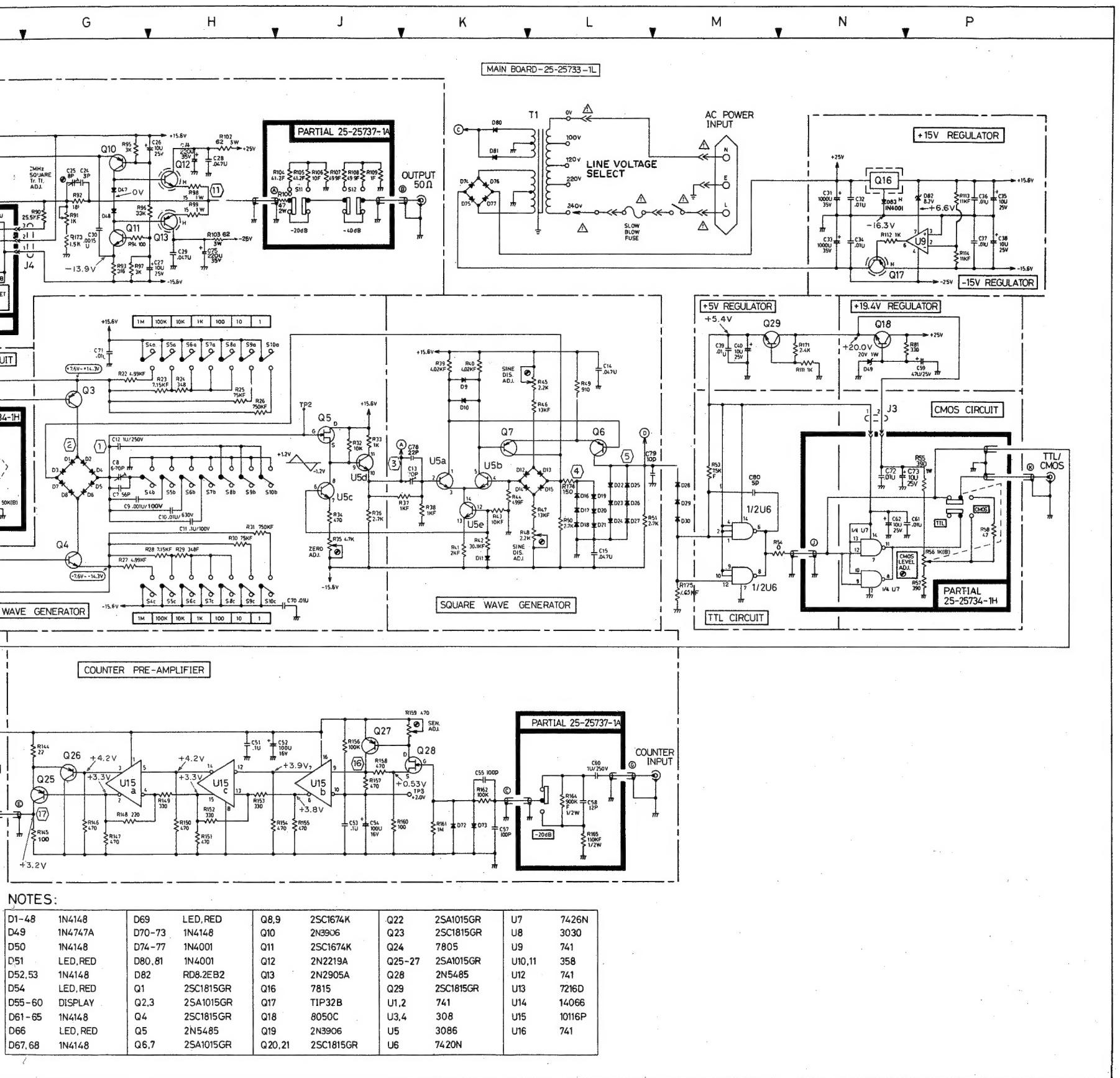
PARTS LIST

REF. NO	PARTS NO	NAME & DESCRIPTION	REF. NO	PARTS NO	NAME & DESCRIPTION
R158	RD14BB2C471J	RES. CARBON 470 5% 1/6W	C057	CC45CH1H101J	CAP. CERAMIC 100P 5% 50V
R159	R12-0058-05	RES. SEMI FIXED 470 B	C058	CC45CH1H120J	CAP. CERAMIC 12P 5% 50V
R160	RD14BB2C101J	RES. CARBON 100 5% 1/6W	C059	CE04EW1E470M	CAP. ELECTRO 47 20% 25V
R161	RD14BB2C105J	RES. CARBON 1M 5% 1/6W	C060	CK45F1H103Z	CAP. METAL FILM 1 10% 250V
R162	RD14BB2C104J	RES. CARBON 100K 5% 1/6W	C061	CK45F1H103Z	CAP. CERAMIC 0.01 50V
R163	NO USE		C062	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
R164	R92-1424-08	RES. METAL FILM 900K 1% 1/6W	C063	CK45F1H104Z	CAP. CERAMIC 0.1 50V
R165	RN14BK2H1103F	RES. METAL FILM 110K 1% 1/2W	C064	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
R166	NO USE		C065	CK45F1H103Z	CAP. CERAMIC 0.01 50V
R167	R01-3521-08	V.R. WITH SW 10KB	C066	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
R168	R01-3521-08	V.R. WITH SW 10KB	C067	CK45F1H103Z	CAP. CERAMIC 0.01 50V
R169	RD14BB2C103J	RES. CARBON 10K 5% 1/6W	C068	CK45F1H103Z	CAP. CERAMIC 0.01 50V
R170	RD14BB2C103J	RES. CARBON 10K 5% 1/6W	C069	NO USE	
R171	RD14BB2C242J	RES. CARBON 2.4K 5% 1/6W	C070	CK45F1H103Z	CAP. CERAMIC 0.01 50V
R172	RD14BB2C224J	RES. CARBON 220K 5% 1/6W	C071	CK45F1H103Z	CAP. CERAMIC 0.01 50V
R173	RD14BB2C152J	RES. CARBON 1.5K 5% 1/6W	C072	CK45F1H103Z	CAP. CERAMIC 0.01 50V
R174	RD14BB2C151J	RES. CARBON 150 5% 1/6W	C073	CE04EW1E100M	CAP. ELECTRO 220 20% 35V
R175	RN14BK2C1651F	RES. METAL FILM 1.65K 1% 1/6W	C074	CE04EW1V221M	CAP. ELECTRO 220 20% 35V
R176	R12-0058-05	RES. SEMI FIXED 470 B	C075	CE04EW1V221M	CAP. ELECTRO 220 20% 35V
R177	RN14BK2C2803F	RES. METAL FILM 280K 1% 1/6W	C078	CC45CH1H220J	CAP. CERAMIC 22P 5% 50V
R178	R92-1430-08	TERMISTOR, NTC 100 OHM	C079	CC45CH1H100D	CAP. CERAMIC 10P 0.5P 50V
			C080	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V
REF. NO	PARTS NO	NAME & DESCRIPTION	CAPACITOR		
C001	CK45F1H473Z	CAP. CERAMIC 0.047 50V	CAPACITOR		
C002	CC45CH1H101J	CAP. CERAMIC 100P 5% 50V			
C003	CC45CH1H101J	CAP. CERAMIC 100P 5% 50V			
C004	CK45F1H473Z	CAP. CERAMIC 0.047 50V			
C007	CC45CH1H560J	CAP. CERAMIC 56P 5% 50V			
C008	C05-0451-08	CAP. TRIMMER 70PF			
C009	C91-1259-08	CAP. POLYE FILM 0.001 2% 100V			
C010	C91-1258-08	CAP. METAL FILM 0.01 2% 630V			
C011	C91-1257-08	CAP. METAL FILM 0.1 2% 100V			
C012	C91-1262-08	CAP. METAL FILM 1 2% 250V			
C013	C05-0466-08	CAP. TRIMMER 70PF			
C014	CK45F1H473Z	CAP. CERAMIC 0.047 50V			
C015	CK45F1H473Z	CAP. CERAMIC 0.047 50V			
C016	NO USE				
C017	CK45F1H103Z	CAP. CERAMIC 0.01 50V			
C018	CC45CH1H220J	CAP. CERAMIC 22P 5% 50V			
C019	CK45F1H103Z	CAP. CERAMIC 0.01 50V			
C020	CC45CH1H390J	CAP. CERAMIC 39P 5% 50V			
C021	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V			
C022	CC45CH1H390J	CAP. CERAMIC 39P 5% 50V			
C023	C05-0465-08	CAP. TRIMMER SPF			
C024	CC45CH1H030C	CAP. CERAMIC 3P 0.25P 50V			
C025</					

SCHEMATIC DIAGRAM

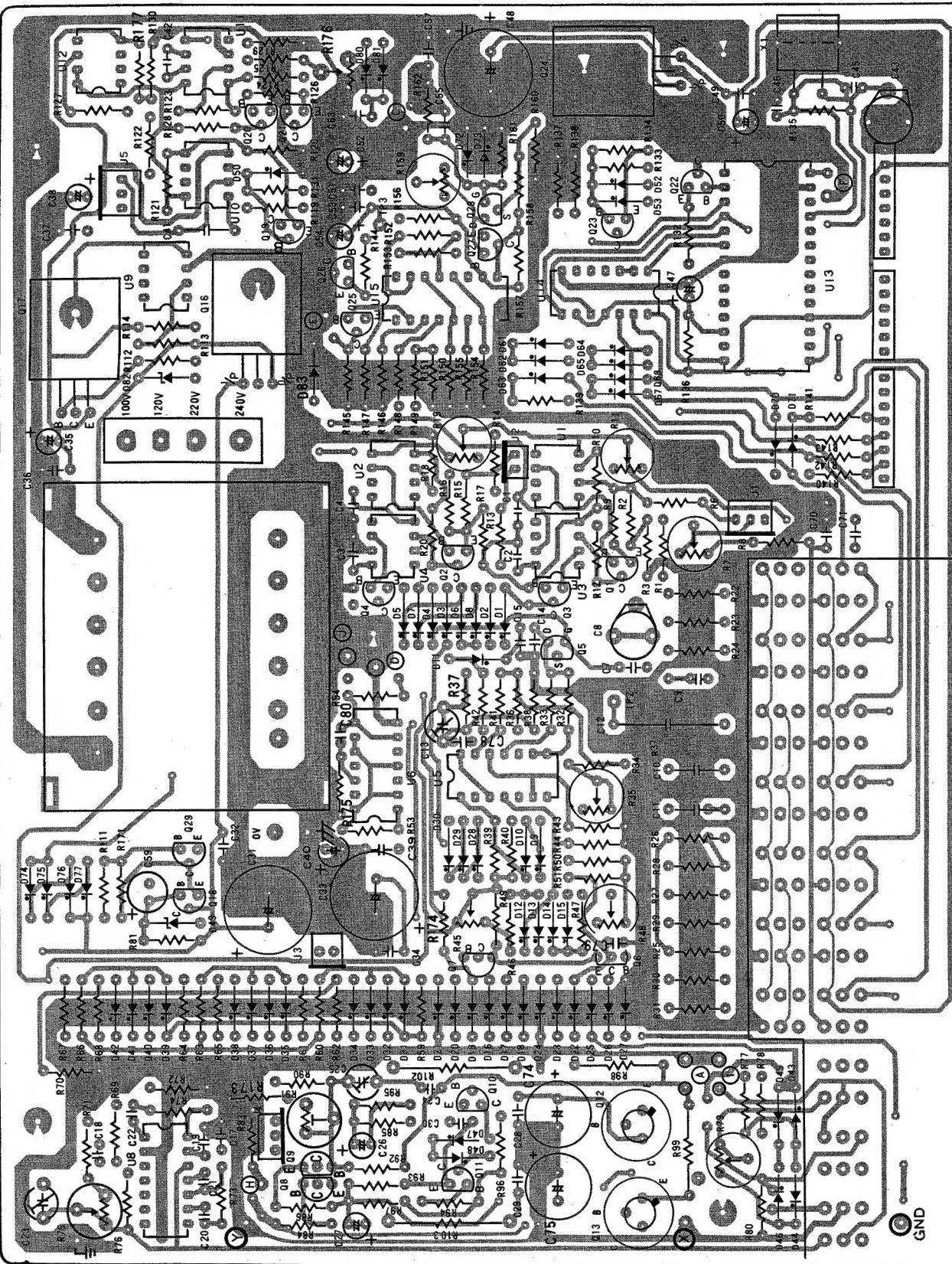


SCHEMATIC DIAGRAM

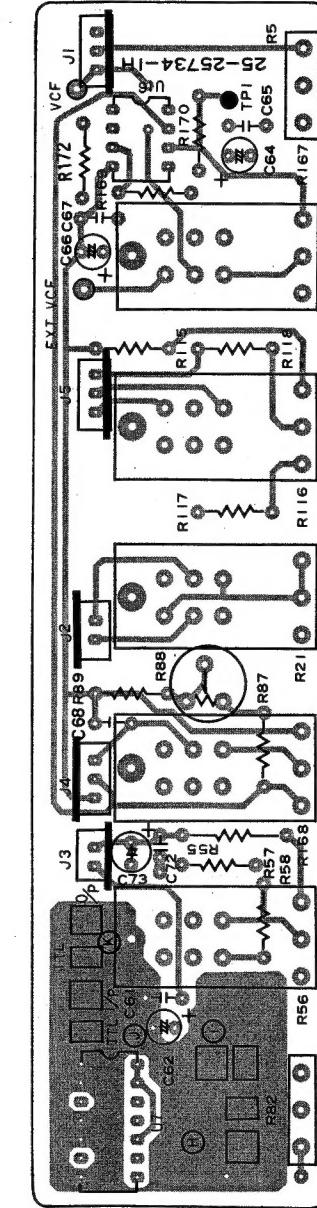


P.C. BOARD

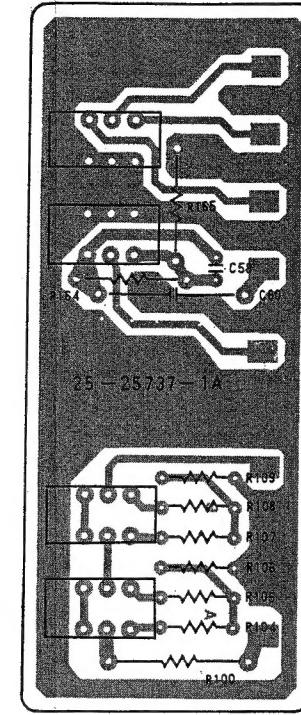
MAIN UNIT (W02-0454-08)



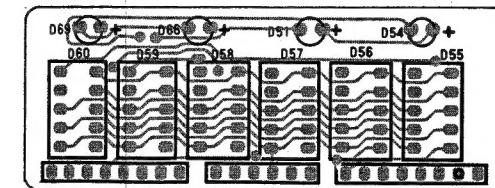
EXT VCF UNIT
(W02-0456-08)



ATT. UNIT
(W02-0457-08)



DISPLAY UNIT
(W02-0455-08)



EXT VCF UNIT
(W02-0456-08)

